Factsheet

Unplanted Drying Beds

العربية (/ar/sanitation-systems/sanitation-technologies/unplanted-drying-beds)

Applicable to
System 1 (/humanitarian-crises/rural-settings/sanitation/sanitation-systems/system-1%3A-single-pit-system)
System 6 (/humanitarian-crises/rural-settings/sanitation/sanitation-systems/system-6%3A-blackwater-treatment-system-with-infiltration)
System 7 (/humanitarian-crises/rural-settings/sanitation/sanitation-systems/system-7%3A-blackwater-treatment-system-with-effluent-transport)
System 8 (/humanitarian-crises

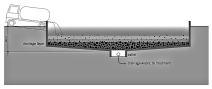
Application level
- [x] City
- [ ] Household
- [x] Neighborhood

Management level
- [ ] Household
- [x] Public
- [ ] Shared

Inputs
Sludge

Outputs
Sludge
Effluent

/urban-settings
/sanitation
/sanitation-systems
/system-8%3A-
blackwater-transport-
to-%28semi-%29-
centralized-
treatment-system)
System 9
(/sanitation-systems
/sanitation-systems
/system-9%3A-
sewerage-system-
with-urine-diversion)



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Adapted from

Compendium of Sanitation Systems and Technologies. 2nd Revised Edition (/node/5587)

Executive Summary

An unplanted drying bed is a simple, permeable bed that, when loaded with sludge, collects percolated leachate and allows the sludge to dry by evaporation. Approximately 50% to 80% of the sludge volume drains off as liquid or evaporates. The sludge, however, is not effectively stabilized or sanitized.

Advantages

- Good dewatering efficiency, especially in dry and hot climates
- Can be built and repaired with locally available materials
- Relatively low capital costs; low operating costs
- Simple operation, only infrequent attention required

Disadvantages

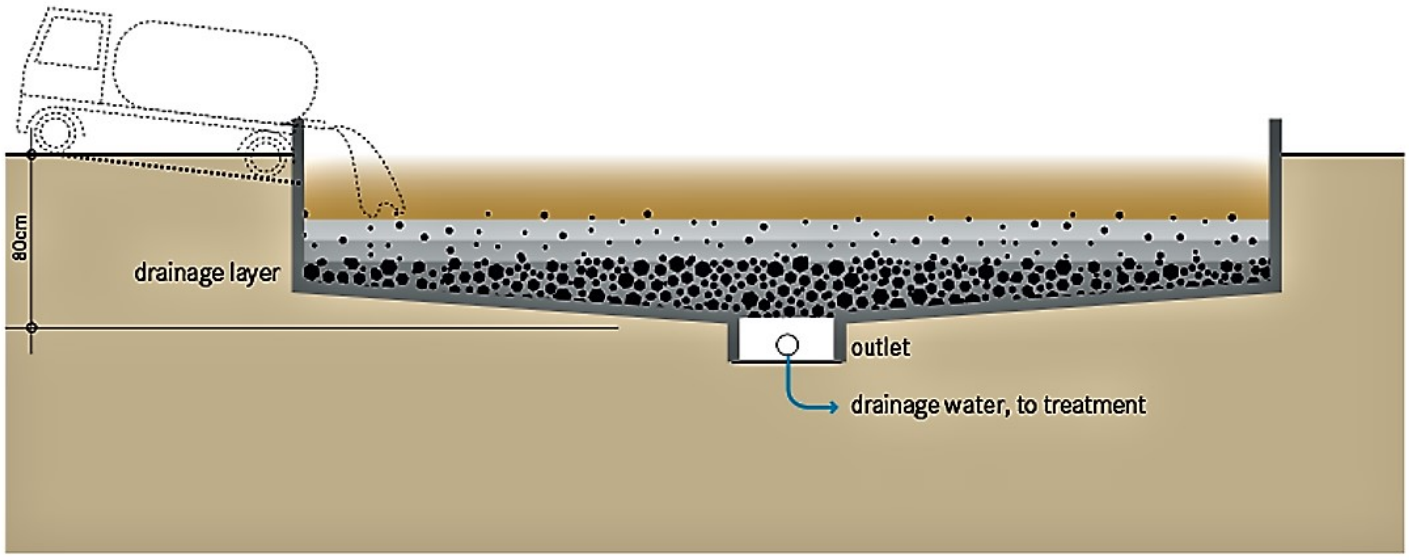
- Requires a large land area
- Odours and flies are normally noticeable
- Labour intensive removal
- Limited stabilization and pathogen reduction
- Requires expert design and construction supervision

- No electrical energy is required
- Leachate requires further treatment

In	Out
Faecal Sludge	Compost (for further off-site composting), Soil, Treated Water, Fertigation Water or Water requiering further treatment

Introduction

The bottom of the drying bed is lined with perforated pipes to drain the leachate away that percolates through the bed. On top of the pipes are layers of gravel and sand that support the sludge and allow the liquid to infiltrate and collect in the pipe. It should not be applied in layers that are too thick (maximum 20 cm), or the sludge will not dry effectively. The final moisture content after 10 to 15 days of drying should be approximately 60%. When the sludge is dried, it must be separated from the sand layer and transported for further treatment, end-use or final disposal. The leachate that is collected in the drainage pipes must also be treated properly, depending on where it is discharged.



Schematic of an unplanted drying bed. Source: TILLEY et al. (2014)

Design Considerations

The drainage pipes are covered by 3-5 graded layers of gravel and sand. The bottom layer should be coarse gravel and the top fine sand (0.1 to 0.5 mm effective grain size). The top sand layer should be 250 to 300 mm thick because some sand will be lost each time the sludge is removed To improve drying and percolation, sludge application can alternate between two or more beds. The inlet should be equipped with a splash plate to prevent erosion of the sand layer and to allow for even distribution of the sludge.

Designing unplanted drying beds has to consider future maintenance because ensuring access to people and trucks for pumping in the sludge and removing the dried sludge is essential.

If installed in wet climates, the facility should be covered by a roof and special caution should be given to prevent the inflow of surface runoff.

Health Aspects/Acceptance

Both the incoming and dried sludge are pathogenic; therefore, workers should be equipped with proper protection (boots, gloves, and clothing). The dried sludge and effluent are not sanitized and may require further treatment or storage, depending on the desired end-use.

The drying bed may cause a nuisance for nearby residents due to bad odours and the presence of flies. Thus, it should be located sufficiently away from residential areas.

Operation and Maintenance

Trained staff for operation and maintenance is required to ensure proper functioning.

Dried sludge can be removed after 10 to 15 days, but this depends on the climate conditions. Because some sand is lost with every removal of sludge, the top layer must be replaced when it gets thin. The discharge area must be kept clean and the effluent drains should be regularly flushed.

Applicability

Sludge drying is an effective way to decrease the volume of sludge, which is especially important when it has to be transported elsewhere for further treatment, end-use or disposal. The technology is not effective at stabilizing the organic fraction or decreasing the pathogenic content. Further storage or treatment (e.g., **Co-Composting (/sswm-university-course/module-6-disaster-situations-planning-and-preparedness/further-resources/%28co-%29-composting-%28large-scale%29)**) of the dried sludge might be required.

Unplanted drying beds are appropriate for small to medium communities with populations up to 100,000 people, but larger ones also exist for huge urban agglomerations. They are best suited for rural and peri-urban areas where there is inexpensive, available space situated far from homes and businesses. If designed to service urban areas, unplanted drying beds should be at the border of the community, but within economic reach for motorized emptying operators.

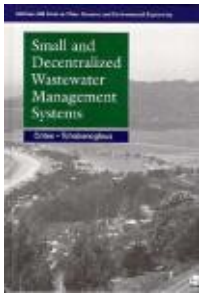
This is a low-cost option that can be installed in most hot and temperate climates. Excessive rain may prevent the sludge from properly drying.

Media PPT

Sludge Drying Beds (PPT) (/media/5)

Library References

Small and Decentralized Wastewater Management Systems



Decentralised wastewater management presents a comprehensive approach to the design of both conventional and innovative systems for the treatment and disposal of wastewater or the reuse of treaded effluent. Smaller treatment plants, which are the concern of most new engineers, are the primary focus of this book.

CRITES, R. TCHOBANOGLOUS, G. (1998): Small and Decentralized Wastewater Management Systems. New York: The McGraw-Hill Companies Inc

Use of Reed Beds for Faecal Sludge Dewatering

This study project tested reed beds for their ability to treat septage.

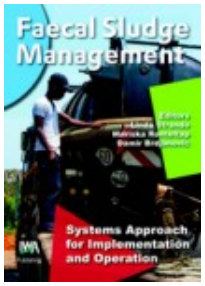
HEINSS, U. KOOTAATEP, T. (1998): Use of Reed Beds for Faecal Sludge Dewatering. A Synopsis of Reviewed Literature and Interim Results of Pilot Investigations with Septage Treatment in Bangkok, Thailand. Duebendorf and Bangkok: Swiss Federal Institute of Aquatic Science (Eawag), Department of Water and Sanitation in Developing Countries (Sandec) and Asian Institute of Technology (AIT)

Faecal Sludge Treatment

This document reviews current practices of faecal sludge management and treatment.

MONTANGERO, A. STRAUSS, M. (2004): Faecal Sludge Treatment. Duebendorf: Swiss Federal Institute of Aquatic Science (EAWAG), Department of Water and Sanitation in Developing Countries (SANDEC) **URL (https://www.susana.org/en/knowledge-hub/resources-and-publications/library/details/406)** [Accessed: 10.06.2019]

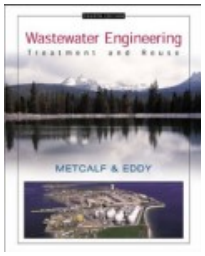
Faecal Sludge Management



This is the first book to compile the current state of knowledge on faecal sludge management. It addresses the organization of the entire faecal sludge management service chain, from the collection and transport of sludge, to the current state of knowledge of treatment options, and the final end use or disposal of treated sludge. It presents an integrated approach that brings together technology, management, and planning, based on Sandec's 20 years of experience in the field. It also discusses important factors to consider when evaluating and upscaling new treatment technology options. The book is designed for undergraduate and graduate students, engineers, and practitioners in the field who have some basic knowledge of environmental and/or wastewater engineering.

STRANDE, L. ; RONTELTAP, M. ; BRDJANOVIC, D. (2014): Faecal Sludge Management. Systems Approach for Implementation and Operation. London: IWA Publishing **URL (http://www.sandec.ch/fsm_book)** [Accessed: 16.07.2014]

Wastewater Engineering, Treatment and Reuse



TCHOBANOGLOUS, G. BURTON, F. L. STENSEL, H. D. METCALF & EDDY Inc. (2003): Wastewater Engineering, Treatment and Reuse. (= Fourth Edition). New York: McGraw-Hill Companies, Inc.